Editor's Choice: Contemporary Treatment of Popliteal Artery Aneurysm in Eight Countries: A Report from the Vascunet Collaboration of Registries

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WHAT THIS PAPER ADDS

Popliteal artery aneurysm is the most common peripheral aneurysm, yet data on this disease are limited. The great differences between countries regarding the treatment of popliteal artery aneurysm, found in this descriptive study, are thought-provoking and will, hopefully, result in more focused research in the future. The vascular registries need to be revised and collect more precise data on pathology, indication, treatment and outcome in the future, and those variables described herein.

Objectives: To study contemporary popliteal artery aneurysm (PA) repair.

Methods: Vascunet is a collaboration of population-based registries in 10 countries: eight had data on PA repair (Australia, Finland, Hungary, Iceland, New Zealand, Norway, Sweden, and Switzerland).

Results: From January 2009 until June 2012, 1,471 PA repairs were registered. There were 9.59 operations per million person years, varying from 3.4 in Hungary to 17.6 in Sweden. Median age was 70 years, ranging from 66 years in Switzerland and Iceland to 74 years in Australia and New Zealand; 95.6% were men and 44% were active smokers.

Elective surgery dominated, comprising 72% of all cases, but only 26.2% in Hungary and 39.7% in Finland, ($p < .0001$). The proportion of endovascular PA repair was 22.2%, varying from 34.7% in Australia, to zero in Switzerland, Finland, and Iceland ($p < .0001$). Endovascular repair was performed in 12.2% of patients with acute thrombosis and 24.1% of elective cases ($p < .0001$). A vein graft was used in 87.2% of open repairs, a synthetic or composite graft in 12.7%.

Follow-up was until discharge or 30 days. Amputation rate was 2.0% overall: 6.5% after acute thrombosis, 1.0% after endovascular, 1.8% after open repair, and 26.3% after hybrid repair ($p < .0001$). Mortality was 0.7% overall: 0.1% after elective repair, 1.6% after acute thrombosis, and 11.1% after rupture.

Conclusions: Great variability between countries in incidence of operations, indications for surgery, and choice of surgical technique was found, possibly a result of surgical tradition rather than differences in case mix. Comparative studies with longer follow-up data are warranted.

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INTRODUCTION

Popliteal artery aneurysm (PA) is the most commonly treated extracranial aneurysm outside of the aorta, and thus constitutes an important clinical problem. Despite this, the disease is rare and difficult to study with a scientific approach. In Sweden, between 1994 and 2001, the incidence of PA repair was only 8.3 per million person years.[1] Consequently, most previous reports on PA are case series from single institutions.[2–5] One prospective multi-centre study was published from the UK Joint Vascular Research Group in 1994.[6] Two large observational studies, based on prospectively reported data collected from vascular centres in Sweden[1] and the USA,[7] and supplemented by review of

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the patient's records, were published in 2007—2008. The Swedish study also re-examined patients a median 7 years after PA repair, and reported a very high frequency of multiple aneurysm disease: abdominal aortic aneurysm (AAA), bilateral PAs, and of other extracranial peripheral aneurysms.[8]

In recent years, many investigators have reported single centre experiences on an increased use of endovascular repair of PA, although one of the pioneers in this treatment, the Groningen group, reported a high frequency of stent-fractures after endovascular repair.[9] Galiñanes et al.[10] recently reported an investigation on patients operated on for lower extremity artery aneurysms, predominantly, but not exclusively, PAs, from the Medicare & Medicaid database 2005—2007. A total of 2,962 patients was identified and endovascular interventions significantly increased over this short timespan, from 12% to 24%. No data on the use of endovascular PA repair in large populations outside of the USA exist.

Vascunet is a collaboration of population-based registries in Europe, Australia, and New Zealand that started in 1997.[11] At present, 10 countries contribute to the common database, and previous reports on AAA repair,[12] carotid endarterectomy,[13,14] and lower limb bypass surgery[15] have been published. The aim of this investigation was to explore the contemporary treatment of PA in the collaborating countries.

METHODS

In May 2012 the 10 collaborating national and regional registries were invited to participate, and a common set of variables was agreed upon. Denmark was not able to distinguish PA from other peripheral aneurysms of the lower limb, that is, from femoral aneurysms in their databases, and could therefore not participate in this investigation. The UK did not have any data on endovascular repair, and also had difficulties in distinguishing PA from other peripheral aneurysms of the lower limb. Finland submitted data from the Helsinki and Vaasa regions only. In all, data from eight countries were included.

A common dataset was agreed upon (Table 1), that is, participant registries recoded their data to conform to this common format. Not all registries could provide all the variables (see 'Results'). A hybrid procedure was defined as an open surgical and an endovascular operation being performed simultaneously. The registries in Finland, Iceland, Norway, and Sweden register follow-up at 30 days and the others at discharge.

Statistical comparisons were performed with Fisher's exact test for dichotomous variables (such as amputations), when two groups were compared. When multiple countries were compared, either analysis of variance or Pearson's chi-square test with different degrees of freedom were used as appropriate.

RESULTS

The operations were performed between January 2009 and June 2012, and a total of 1,471 PA repairs were included in the common database. Time periods and catchment areas differed, as described in Table 2. Most repairs (77.1%) were performed between 2010 and 2011, 19.1% during 2009 and only 3.8% during 2012. The largest number of cases was submitted from Sweden (495; 34%) and Australia (441; 30%); the remaining countries/regions constituted 36% of the database. The overall number of operations per million person years was 9.59, but varied considerably, from 3.4 in Hungary to 17.6 in Sweden.

The median age of the patients was 70 years, ranging from 66 years in Switzerland and Iceland to 74 years in Australia and New Zealand. As expected, most patients (95.6%) were men. The 64 women had a median age of 73.5 years, which was not significantly older than the men ($p = .46$). The small number of women reduced the power when analysing gender differences. The proportion of patients $\geq$80 years of age was 19.2% among men and 18.8% among women.

The risk factors diabetes, cardiac history, pulmonary history and hypertension were registered in almost 100% of cases, cerebrovascular event in 54.8% and smoking history in 91.5%. Overall and national prevalences of the risk factors are given in Table 3; differences between countries were all statistically significant ($p < .0001$).

The indication for treatment varied considerably between the countries ($p < .0001$) (Table 4). Elective surgery dominated in most countries, accounting overall for 72% of cases, but it was as low as 26.2% in Hungary and 39.7% in Finland.

Endovascular repair was performed in 326 patients 22.2% (endovascular only in 307, hybrid operations in 19) (Table 5). The proportion of endovascular repair varied considerably from 34.7% in Australia to zero in Switzerland, Finland, and Iceland ($p < .0001$).

The choice of technique was also dependent on the indication. Endovascular technique was performed in only 12.2% of those operated on for emergency thrombosis compared with 24.1% of the elective cases ($p < .0001$). Of the 19 hybrid cases, 15 (79%) were performed for emergency thrombosis. Four of the 18 patients treated for rupture (22%) were operated on with an endovascular technique. There was a higher proportion of endovascular repair among women (34.4%) than among men (21.6%) ($p = .031$). Among patients $\geq$80 years of age, however, a higher proportion was treated with endovascular repair among men (39.6%) compared with women (25.0%), $p = .031$.

All countries except Hungary registered the graft used during open repair. Among the 988 patients, 862 (87.2%) were operated on with a vein, 116 with a synthetic graft (11.7%), and 10 (1%) with a composite graft. The only country that registered the diameter of the PAs was Norway. The median diameter was 30 mm (range 10—90 mm), and only 3/168 patients (1.8%) had a diameter <15 mm.

The inflow and outflow anatomy was available in 79.5% and 80.3% of the procedures. The femoral artery dominated (51.4%), followed by the popliteal artery (24.8%), and other inflow, such as a graft in 2.9%. The outflow vessel was most frequently the popliteal artery below the knee (58.7%),

Table 1. Popliteal aneurysm data dictionary.

Fields	Description on form	Possible responses	Format of field
Country	Country	AUS, NZ, UK, Sweden, DM, Finland, Hungary, Italy, Switzerland	Text
Hospital ID	Hospital dode or identifier	Number/letter combination	Text
Patient age	Age of patient at the time of surgery	Whole number	Integer
Patient ID	Patient identifier (allocated by country and anonymised)	Number/letter combination	Text
Gender	Sex	Male, female	1 = male, 2 = female
Admission date	Date of admission	Date	dd/mm/yyyy
Admission mode	Mode of admission	Elective, emergency	1 = elective, 2 = emergency
Diabetes	Diabetes	Yes or no	0 = no, 1 = yes
Cardiac history	Cardiac history—any IHD or CCF	Yes or no	0 = no, 1 = yes
Current smoker	Current smoker (within 2 months)	Yes or no	0 = no, 1 = yes
Pulmonary history	Symptomatic lung disease	Yes or no	0 = no, 1 = yes
Cerebrovascular event	Previous stroke or TIA	Yes or no	0 = no, 1 = yes
History			
Hypertension history	Hypertension	Yes or no	0 = no, 1 = yes
Preoperative data			
Indication	Indication for surgery	Elective, emergency thrombosis, emergency rupture	1 = elective, 2 = emergency thrombosis, 3 = emergency rupture
Side of operation	Side of symptomatic leg	Right or left	1 = right, 2 = left
ABI	Ankle brachial pressure index	Number to 1 decimal point	Number (0—1.5)
Operative data			
Operation date	Date of operation	Date dd/mm/yyyy	
Procedure	Endovascular or open surgery	Endovascular, open, hybrid	1 = endovascular, 2 = open surgery, 3 = hybrid
Access route	Access route	Medial, dorsal, other, endovascular	1 = medial, 2 = dorsal, 3 = other, 4 = endovascular
Proximal anastomosis site	Anatomic site of proximal anastomosis	Iliac, femoral, popliteal, other	1 = iliac, 2 = femoral, 3 = popliteal, 4 = other
Distal anastomosis site	Anatomic site of distal anastomosis	Popliteal above knee, popliteal below knee, crural, pedal, other	1 = popliteal above knee, 2 = Popliteal below knee, 3 = crural, 4 = pedal, 5 = other
Graft type	Type of graft	Vein, synthetic, composite	1 = Vein, 2 = synthetic, 3 = composite
Additional open procedure	Additional open procedure at time of surgery	Yes or no	0 = no, 1 = yes
AEP	AEP at time of surgery	Yes or no	0 = no, 1 = yes
Preoperative thrombolysis	Preoperative thrombolysis	Yes or no	0 = no, 1 = yes
Perioperative thrombolysis	Perioperative thrombolysis	Yes or no	0 = no, 1 = yes
Follow-up (in hospital or 30 days)			
Discharge date	Date of discharge	Date dd/mm/yyyy	

Table 1-*continued*

Fields	Description on form	Possible responses	Format of field
Wound complication (WC)	WC leading to surgical intervention	Yes or no	0 = no, 1 = yes
Haemorrhage	Reoperation for haemorrhage	Yes or no	0 = no, 1 = yes
Compartment syndrome (CS)	CS requiring fasciotomy	Yes or no	0 = no, 1 = yes
Graft patent at discharge	Graft patent at discharge	Yes or no	0 = no, 1 = yes
Graft patent at 30 days	Patent graft at 30 days	Yes or no	0 = no, 1 = yes
Amputation	Amputation at ankle or higher on ipsilateral side	Yes or no	0 = no, 1 = yes
ABI	Ankle brachial pressure index	Number to 1 decimal	Number (0–1.5)
Acute coronary event	Acute coronary syndrome, MI, serious arrhythmia, cardiac failure	Yes or no	0 = no, 1 = yes
Major stroke	Major stroke	Yes or no	0 = no, 1 = yes
Died within 30 days of surgery	Deceased at 30 days	Yes or no	0 = no, 1 = yes
Date of death	Date of death (if known)	Date dd/mm/yyyy	
Data based on hospital discharge or 30 days?	Follow-up time	Discharge or 30 days	1 = discharge, 2 = 30 days

Note. ID = identification; IHD = ischaemic heart disease; CCF = congestive cardiac failure; TIA = transient ischaemic attack; AUS = Australia; NZ = New Zealand; DM = Denmark; AEP = additional endovascular procedure; MI = myocardial infarction.

followed by a crural vessel (15.5%), the popliteal artery above the knee (4.6%), and a pedal vessel (0.3%).

Only three of the countries registered the type of open surgical approach: Finland, Norway (Bergen County), and New Zealand. Among the 169 patients operated on in those countries, 145 (85.8%) were operated on with an open medial approach, 15 (8.9%) with an open posterior approach, and nine (5.3%) with endoPA repair.

Sixty-five cases of thrombolysis were registered: 56 from Sweden, five from Norway, three from Finland, and one from Hungary. It was impossible, however, to distinguish if those were pre- or perioperative procedures, and many preoperative thrombolysis procedures may have been registered as separate procedures.

The amputation rates in the participating countries are given in Table 4. The frequencies of major complications, including death and amputation, were difficult to compare between countries, as some countries only reported events during the first hospitalisation episode and others at follow-up 30 days after surgery. Overall, postoperative haemorrhage was registered in 61/1109 (5.5%), compartment syndrome in 13/782 (1.7%), and other wound complications in 129/1115 (11.6%). Acute coronary events were registered in 10/1108 (0.9%) and stroke in 5/853 (0.6%). One year follow-up data could be provided by few of the registries, and even in those was not complete. In Swedvasc, for instance, 2/3 of the patients had 1 year follow-up data. We therefore decided not to analyse those data. When comparing the three countries that had a high proportion of emergency repair (Finland, Hungary, and Switzerland), they had an amputation rate of 3.8% (9/239) compared to the remaining countries, which reported an amputation rate of 1.6% (20/1232; $p = .040$).

The overall major amputation rate was 2.0%. It differed depending on indication with amputation occurring in 6.5% after emergency procedures for thrombosis. It also differed depending on surgical technique: 1.0% after endovascular, 1.8% after open, and 26.3% after hybrid repair ($p < .0001$). The mortality difference between endovascular and open technique was not significant. Ten patients died (0.7%) within 30 days or within the hospital stay, depending on which registry the patients were registered in. Mortality was 0.1% after elective surgery, 1.6% after emergency procedures for thrombosis, and 11.1% after the 27 procedures for rupture.

DISCUSSION

To our knowledge, this is the first attempt to perform a multinational epidemiological overview of the current treatment of PA. The investigation is warranted, given the background of increasing numbers of procedures, and by the introduction of endovascular techniques. The number of operations per million inhabitants per year varied considerably between countries—the difference between Hungary and Sweden was more than fivefold (Table 1). Is this variability a result of differences in prevalence of disease, different diagnostic activity, or perhaps differences in indications for treatment of identified patients? Unfortunately, the database does not contain information to answer those important questions with certainty, but there are some possible explanations that may be discussed. We know from AAA screening studies in Sweden[16,17] and the UK,[18,19] as well as from epidemiological data on AAA rupture and death in Australia[20] and New Zealand[21] that the prevalence of AAA is falling in many of the countries included in this investigation. This fall in AAA prevalence is thought to be explained mainly by falling smoking rates.[17,19] There is a very strong association between PA and smoking and the coexistence of AAA. As a consequence, one would expect a decrease in the incidence of PA repair, but the opposite is found in Sweden. In a

Table 2. Participating countries, time periods, population covered, number of operations, and incidence of operations per million inhabitants.

Country	Time period	Population millions	Number of operations	Operations/million inhabitants/year
Australia	2010–2011	22.5	441	9.9
Finland (Helsinki)[a]	2009–2011	1.37[a]	58	13.9
Hungary	2009–2012[b]	9.96	103	3.4
Iceland	2009–2011	0.35	6	5.7
Norway	2009–2012[b]	4.7	188	11.9
New Zealand	2010–2012[b]	4.4	93	7.0
Sweden	2009–2011	9.5	495	17.6
Switzerland[c]	2009–2011	5.6[c]	87	5.2
All	**2009–2012**	**58.4**	**1471**	**9.59**

Note. The other countries included national data.
[a] Finland included defined regional data.
[b] The countries including 2012 only included the first 3–6 months of that year.
[c] The Swiss registry covers approximately 70% of the entire population of eight million inhabitants.

previous investigation from the same Swedvasc registry 1994–2001 the incidence of PA repair was only 8.3 per million person years[1] compared with 17.6 during 2009–2011—an increase of 112%.

The increase in prevalence observed in Sweden could be a result of an increased awareness of the association between AAA and PA,[8] in combination with an increased detection rate of AAA in the population by screening. The screening programme in Sweden was initiated in 2006,[16] and many of the screening detected AAA patients were probably screened for PA with ultrasound, as this is a routine in most Swedish hospitals, but not in the other countries participating in this investigation. There may also be national differences in how patients with acute limb ischaemia are assessed. If no ultrasound examination is performed in a patient with an acute thrombosis of the popliteal artery, an underlying PA may not be detected.

The great differences in disease prevalence may also be explained by ethnicity and hereditary factors. It has been shown in AAA disease that there is a strong interaction between heredity and environment.[22] Although there are less data on patients with PA, we have reasons to believe that the same interaction is present in these patients, who often have concomitant AAA.

The main risk factors for AAA, smoking, and male sex, dominate even more in the PA population. Svensjö et al.[17] reported that 33% of 373 65-year-old men screened were smokers compared to 44% in this cohort of patients with PA. In another report from Vascunet, Mani et al.[12] reported that 13.3% of patients after intact AAA repair and 16.2% after ruptured AAA repair were women compared to only 4.6% in this cohort of patients with PA.

Ravn et al.[23] reported that late expansion was common after open PA repair, 33% after a mean of 7.2 years, when the medial approach was used—a complication similar to type II endoleak after endovascular aneurysm repair (EVAR). This complication, that was virtually non-existent after an operation with a posterior approach, was associated with symptoms in most patients, and some even required reoperation. Unfortunately, the choice of surgical access in open surgery was reported from only three countries in this investigation, but the medial approach dominated with 85%. Several of the registries are now adding this variable to their databases, so we will know in the future if a shift in the choice of surgical access route takes place.

This study focused on the definitive repair of PA. Unfortunately, we were unable to identify all the patients who first underwent intra-arterial thrombolysis, followed by definitive open or endovascular repair, and to distinguish those from patients who underwent perioperative thrombolysis. One of the effects of this kind of exercise, merging data from different registries, is that variables are added when missing and amended when necessary, thus facilitating future research. A variable indicating preoperative thrombolysis (yes/no) was added to the Swedvasc registry when registering carotid procedures 2 years ago, and is now

Table 3. Prevalence of preoperative risk factors. All values are given as percentages.

Risk factor	All	Aus	Fin	Hun	Ice	Nor	NZ	Swe	Swi	p[a]
Cardiac history	37.1	50.1	48.3	39.8	50.0	41.5	37.6	23.4	27.6	<.0001
Pulmonary history	14.0	miss	15.5	19.4	0.0	15.4	miss	9.5	10.3	<.0001
Hypertension	72.4	83.2	77.6	86.4	66.7	58.0	75.3	62.2	83.9	<.0001
Cerebrovascular event	9.0	miss	10.3	miss	0.0	12.2	miss	8.7	4.6	<.0001
Diabetes	16.2	16.6	20.7	26.2	33.3	16.0	12.9	13.3	19.5	<.0001
Current smoking	44.0	76.2	46.3	47.6	16.7	37.2	8.6	21.4	57.5	<.0001

Note. All = average proportion of all countries with data; Aus = Australia; Fin = Finland; Hun = Hungary; Ice = Iceland; Nor = Norway, NZ = New Zealand; Swe = Sweden; Swi = Switzerland; miss = missing data in this particular registry.
[a] p-Values refer to differences between countries.

Table 4. Indications for treatment of popliteal artery aneurysm in the different countries studied.

Country	All (*n*)	Elective surgery (*n*)	%	Emergency surgery (*n*)[a]	%
Australia[a]	441	380	86.2	61	13.8
Finland (Helsinki)	58	23	39.7	35	60.3
Hungary	103	27	26.2	76	73.8
Iceland	6	6	100	0	0.0
Norway[a]	188	151	80.3	37	19.7
New Zealand	93	60	64.5	33	35.5
Sweden[a]	495	370	74.7	125	25.3
Switzerland	87	42	48.3	45	51.7
All	**1,471**	**1,059**	**72.0**	**412**	**28.0**

Note.
[a] Most emergency operations were performed for acute thrombosis and/or embolism, but 27 patients (1.8%) were operated on for rupture (six in Australia, 11 in Norway, and 10 in Sweden).

being added also to the PA module, and if more countries join a future analysis of this data will turn possible.

The effect of preoperative thrombolysis on short- and long-term results was not possible to analyse in this database, the reason being that this intervention could be registered either as an independent operation, or as a part of the open or endovascular procedure aimed at repairing the PA. This limitation of the participating registries was highlighted by this project, and several of the registries are preparing to revise their registration to enable such an analysis in the future. This is, in fact, one of the most important results of the Vascunet collaboration, that is, that the registries are adapted and amended as a result of previous investigations.[10—15]

Among the most interesting observations are the great differences between countries in indications for treatment and in frequency of endovascular repair. If we exclude Iceland, which is a small country in which only six patients were operated on, the proportion of elective repairs varied between 86% in Australia and only 26% in Hungary (Table 3). These differences probably reflect both the level of diagnostic activity and the therapeutic tradition, whether to treat asymptomatic patients or not, including the diameter threshold and if the presence of thrombosis in smaller aneurysms is considered an indication for surgery. Unfortunately, we only have information for the diameter of the PA from one country (Norway). That country, however, had one of the highest proportions of elective repairs (80%) and yet only 2% had a diameter <15 mm. It will be interesting to perform a study in the future to assess whether the countries that presently have a predominance of emergency repair (Hungary, Finland, and Switzerland) have a higher proportion of elective repairs. As expected, the patients in these countries having a high proportion of emergency repair, also suffered a significantly higher risk of amputation, thus identifying an area of quality improvement.

Similar differences between countries were identified regarding the proportion of endovascular repair (Table 4). The highest proportion of endovascular repairs was found in Australia and Sweden. Countries with a high proportion of endovascular repair often also had a high incidence of operations per million inhabitants (Tables 2 and 3), and we have speculated that this trend might be explained by operating on older patients with endovascular techniques rather than open surgery. This does not seem to be the case, however: Australia has a median age of 74 years, but in Sweden the median is only 69 years, compared with the average of 70 years. It seems that the choice of surgical technique is more a result of surgical tradition than differences in case mix. Interestingly, the overall proportion of endovascular repairs in the studied countries (22.2%) was quite similar to that reported from the USA in 2007 (23.6%).[10]

These trends are similar to those in intact AAA repair, where we previously reported that Finland and Hungary had the lowest, and Australia and Sweden the highest, proportion of EVAR.[12] While we have multiple randomised trials guiding us in the choice of open or endovascular repair of AAA,[24—27] there are no similar data on how to treat PA, yet the trends are similar. Thus, it seems that therapeutic tradition rather than evidence guides vascular surgeons. A randomised trial comparing the techniques is certainly warranted. That could also supply us with long-term follow-up, which is crucial to evaluate the two

Table 5. The proportion of open and endovascular surgery for popliteal artery aneurysm in the different countries studied.

Country	All repairs	Open repair (*n*)	Endovascular repair (*n*)	Endovascular repair (%)
Australia	441	288	153	34.7
Finland (Helsinki)	58	58	0	0.0
Hungary[a]	103	97	6	5.8
Iceland	6	6	0	0.0
Norway	188	171	17	9.0
New Zealand	93	89	4	4.3
Sweden[a]	495	349	146	29.5
Switzerland	87	87	0	0.0
All	**1,471**	**1,145**	**326**	**22.2**

Note.
[a] Sixteen hybrid operations in Sweden and three in Hungary were considered endovascular in this analysis.

Table 6. Suggested variables to be added to the vascular registries.

Pathology/indication	
Diameter of the aneurysm	mm
Thrombosis in the aneurysm	Yes/no
Number of run-off vessels	0—3
Treatment	
Preoperative thrombolysis	Yes/no
Perioperative thrombolysis	Yes/no
Approach during open repair	Medial/posterior
Fasciotomy	Yes/no
Outcome at 30 days and 1 year	
Patency	Yes/no
Amputation	Yes/no
Symptoms	Claudication/ulcer/gangrene

methods. In this investigation we had only short term follow-up, which showed no difference in results. As one of the concerns regarding the new endovascular technique is durability, adding long-term follow-up in the registry databases is of utmost importance.

A potential limitation in all registry data is the risk of selection bias due to insufficient validity. Several of these participating registries have been extensively validated, however (D. Bergqvist, M. Björck, T. Lees, G. Menyhei, submitted).[28,29,30] The Swedvasc was specifically validated for PA operations. Among 717 primary operations for PA, 146 were found to have bilateral operations when the case records were scrutinised; of those, 141 (96.6%) had been registered.[1]

When the variables to be collected were decided upon (Table 1), decisions were based on those available in most of the registries. This analysis has shown that the registries need to be revised and collect more precise data on pathology, indication, treatment and outcome in the future, and those variables given in Table 6.

CONCLUSIONS

In this analysis of contemporary PA repair in eight countries, a great variability in incidence of operations, indications for surgery, and choice of surgical technique was found. Those differences seem to be more a result of surgical tradition than of differences in case mix. The participating registries need to revise their variables to improve recording of the patients who undergo preoperative thrombolysis prior to definite surgical repair, and to introduce at least 1 year of follow-up in order to evaluate medium-term results.

CONFLICT OF INTEREST

None.

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